

INFLUENCE OF SEED SIZE ON STORAGE POTENTIAL OF CHICKPEA VARIETIES

GNYANDEV, B, M. B. KURDIKERI, P. M. SALIMATH, RAVINDERKUMAR & KAILASHNATH

University of Agricultural Sciences, Dharwad, India

ABSTRACT

A storage study involving three Desi (A-1, Bheema and BGD-103) and two kabuli types (ICCV-2 and KAK-2) were sieve graded in to small, medium, big and bulk categories and stored in cloth bag under ambient storage condition at the department of seed science and Technology, university of Agricultural Sciences, Dharwad during 2008-09. The study revealed that among varieties A-1 and BGD- 103 maintained satisfactory germination as per the minimum seed certification standards upto 9 months, Bheema for 8 months and ICCV-2 and KAK-2 for 7 months. Among seed size group was non-significant. However, the smaller and medium sized seeds in both Kabuli and desi chickpea varieties were found better in storability.

KEYWORDS: Chickpea Varieties, Desi (A-1, Bheema and BGD-103) and Two Kabuli Types (ICCV-2 and KAK-2)

INTRODUCTION

Chickpea is third most important pulse crop in the world after beans and peas. In Asia, India is the largest producer of chickpea contributing over 70 per cent of the world production occupying an area of 7.49 million with a production of 6.33 mill tons with productivity of 780 kg/ha. Two types of chickpea are commonly grown in our country of which kabuli varieties are growth in northern parts and desi varieties are grown in other parts of our country. Seed is a basic agriculture input in agriculture. Hence, supply of quality seeds to farmers becomes more essential. However, it has been noticed that good quality seeds of chickpea varieties some time re not available inadequate quantity. Hence, the storage of seed assumes greater importance in seed programmes as “seed saved is seed produced” on old adage. It looks good even in today’s modern agriculture, Storage potential of seeds depends on several factors among which seed size also plays an important role. The Kabuli and Desi Chickpea varieties differ greatly in seed size and are processed and graded using 11.00 (R) top sieve and 4.75 to 6.00 (R) bottom sieve. The storage potential of seeds depends on the genetic factor, initial quality of seed, food reserves, seed size, storage environment etc., (Robert , 1972; Delouche, 1973 and Kurdikeri, 1991). It has been reported that in same crops big seed with ample initial capital of food reserves store for longer period than small seeds (oxlay 1948). On the contrary, small seeds have been proved to store for longer period than big and medium seeds (Mohanro, 1993). However, the studies on influence of seed size on storage potential of chickpea varieties are limited. Hence, present study was initiated in kabuli and deisi types of chickpea varieties which greatly differ in seed size for their storage potential under ambient storage conditions.

MATERIALS AND METHODS

Fresh seeds of Kabuli (ICCV-2 and KAK-2) and Desi (A-1, Bheema and BGD-103) produced during rabi seasons (2007-08) were sieve graded in to small, medium, big and bulk category using different sieves depending upon the seed size of each variety KAK-2 was sieved on 6.80, 7.50 and 8.00 mm (R) and A-1 on 6.40, 7.00 and 7.50 mm (R) and as bulk

seed (unsieved) grade in each varieties. These sieve graded seeds with 8-9 percent initial moisture content were packed in cloth bag and kept under ambient storage conditions at the Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad. The observations on seed quality parameters such as germination, vigour index, moisture content and pest infestation were recorded and presented for few selected months in Table.

RESULTS AND DISCUSSIONS

The longevity of seeds depends on storage environments, initial seed quality per se storage history etc., Further, as per seed size *per se* seeds with large initial capital of food reserves generally store for longer period (oxlay, 1948)

In the present study, the mean germination percentage decreased gradually from 98.42 to 72.72 per cent, the vigour index from 2640 to 1234, moisture content increased from 8.92 to 10.42 percent. Electrical conductivity (EC) from 0.393 to 1.078 dSm⁻¹ and pest infestation from 0.00 to 28.47 percent in initial month to 12 months of storage respectively. In all the chickpea varieties, the decrease in germination and vigour index and increase in moisture content, EC and pest infestation noticed was mainly due to age induces deterioration, decrease in food reserves, increase in percent moisture content and pest infestation (Merwade, 2000).

The influence of seed size grades on seed quality parameters during storage revealed that, decline in germination noticed was from 98.90 to 74.40, 98.27 to 72.47, 97.47 to 71.13 and 95.53 to 72.87 percent in initial month to 12 months of storage in small, medium, big and bulk seeds respectively irrespective of varieties. With the decrease in germination, the vigour index also found to decrease correspondingly an account of gradual increase in seed deterioration due to loss of cellular integrity leading to higher amount of leachate of cell content which is manifested through increase in electrical conductivity values.

Further increase in the moisture content and pest infestation in all the seed size groups might have contributed for decrease in germination and vigour index and the results are in conformity with Merwade (2000) in chickpea.

As per the minimum seed certification standards the satisfactory germination was maintained for 9 months in small and bulk seed size groups while, it was for 8 months in big and bulk seed size groups. Difference in viability among seed size may be related to seed size, protein content, moisture absorption and extent of pest infestation. It has been pointed that small seeds contain more protein which hold tightly the absorbed moisture (Vanangmudi, 1988). Further activity of pest may be lesser in small seeds compared to big seeds on account of lesser food reserves.

The results of interactions between varieties and seed size groups showed no significant differences on viability, vigour index, moisture content, electrical conductivity and pest infestation. However, small seeds of all chickpea varieties recorded more germination and lesser pest infestation throughout storage period compared to other seed size groups. While, the vigour index was relatively more in big, medium and bulk seeds.

In case of small seeds, satisfactory germination (85%) as per the minimum seed certification was maintained upto 9 months in A-1 and BGD-103, for 8 months in Bheema and ICCV-2 and for 7 months in KAK-2. In medium size groups satisfactory germination was maintained for 9 months in A-1 and BGD-103, for 8 months in ICCV-2, Bheema and only for 7 months in KAK-2. While, in big seed, A-1 maintained for 9 months, Bheema and BGD-103 for 8 months and ICCV-2 and KAK-2 for 7 months. The bulk seed maintained for 9 months in A-1 and BGD-103, for 8 months in Bheema and for 7 months in KAK-2 and ICCV-2.

CONCLUSIONS

The study on Influence of Seed size on Storage Potential of Chickpea Varieties Based on the results, it may be concluded that all the Desi Chickpea varieties of small, medium, big & bulk seeds showed longer period of storage potential (8-9 months) while Kabuli varieties showed shorter (7-8 months) period of storage potential.

REFERENCES

1. Delouche, J. C., 1973, Seed maturation, *Seed Prod. Manual*, NSC and Rockefeller Foundation, Pp. 162-165.
2. Kurdikeri, M. B., 1991, Studies on seed quality in hybrid maize (*Zea mays* L.). *Ph.D Thesis*, Univ. of Agric. Sci., Bangalore (India).
3. Merwade, M. N., 2000, Investigations on seed production techniques and storability of chickpea (*Cicer arietinum* L.). *Ph.D. Thesis*, Univ. of Agric. Sci., Dharwad, Karnataka (India).
4. Mohanrao, A., 1993, Influence of genotypes and seed size on seed quality, storability and field performance in soybean [*Glycine max* (L.) Merrill.]. *M.Sc. (Agri.) Thesis*, Univ. of Agric. Sci., Dharwad, Karnataka (India).
5. Oxley, T. A., 1948, The Scientific principles of grain storage, northern publishing Co. Liver Pool, England.
6. Roberts, E. H., 1972, Storage environment and control of viability. In : *Viability of Seeds*, Ed. E. H Roberts, Chapman and Hall Ltd., London, Pp. 14-18.
7. Vanangamudi, K., 1988, Storability of soybean seed as influenced by the variety, seed size and storage container. *Seed Res.*, 16(1) : 81-87.

APPENDICES

Table 1: Effect of Seed Size on Seed Germination in Different Chickpea Genotypes during Storage

Treatments	Storage Months												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Genotypes (V)	Germination (%)												
A-1 (V ₁)	98.16 (83.00)*	97.50 (81.21)	96.42 (78.54)	95.83 (77.24)	93.58 (75.40)	90.97 (72.51)	89.92 (71.48)	88.67 (70.35)	86.33 (68.29)	85.20 (67.28)	83.33 (65.89)	79.83 (63.31)	75.50 (60.33)
ICCV-2 (V ₂)	98.08 (82.52)	95.83 (78.37)	94.92 (77.16)	93.92 (75.78)	92.38 (74.12)	89.28 (70.87)	88.75 (70.42)	86.08 (68.15)	83.83 (66.30)	82.50 (65.29)	79.75 (63.24)	76.33 (60.89)	71.33 (57.63)
KAK-2 (V ₃)	97.75 (82.32)	95.83 (78.39)	94.50 (76.52)	93.25 (74.98)	91.92 (73.58)	88.22 (70.00)	87.00 (68.89)	85.16 (67.41)	83.33 (65.92)	81.83 (64.80)	79.58 (63.13)	70.17 (60.10)	70.25 (56.95)
Bheema (V ₄)	99.00 (85.67)	97.50 (81.32)	96.00 (78.54)	95.50 (77.99)	93.15 (74.89)	90.08 (71.65)	89.83 (71.42)	87.95 (69.73)	85.17 (67.35)	83.58 (66.10)	80.92 (64.09)	72.67 (61.84)	72.17 (58.15)
BGD-103 (V ₅)	99.08 (86.21)	97.75 (81.56)	96.83 (80.24)	95.08 (78.37)	93.83 (75.62)	90.25 (71.82)	90.12 (71.73)	87.96 (69.68)	86.17 (68.16)	84.92 (67.18)	81.83 (64.79)	72.92 (61.28)	74.33 (59.56)
S.Em±	0.41	0.33	0.36	0.28	0.29	0.19	0.18	0.25	0.17	0.24	0.17	0.18	0.47
CD@1%	NS	1.27	1.37	1.08	1.12	0.74	0.69	0.96	0.66	0.90	0.64	0.69	1.81
Seedsize													
Small (G ₁)	98.90(87.19)	97.20 (80.58)	96.13 (79.15)	95.07 (77.35)	93.47 (75.33)	90.73 (72.30)	89.80 (71.41)	87.65 (69.53)	85.53 (67.66)	84.13 (66.59)	81.87 (64.80)	75.13 (62.03)	74.40 (59.60)
Medium (G ₂)	98.27 (83.34)	97.27 (81.04)	96.13 (78.84)	95.13 (77.43)	93.38 (75.18)	89.87 (71.45)	89.40 (71.05)	87.68 (69.50)	85.13 (67.33)	83.27 (65.86)	80.87 (64.06)	74.93 (61.84)	72.47 (58.37)
Big (G ₃)	97.47 (81.04)	96.20 (79.00)	95.13 (77.51)	94.00 (75.97)	92.33 (74.01)	88.83 (70.49)	88.40 (70.19)	86.23 (68.23)	84.53 (66.85)	83.07 (65.76)	80.73 (63.99)	73.53 (60.90)	71.13 (57.51)
Bulk (G ₄)	98.53 (84.20)	96.87 (80.03)	95.53 (77.92)	94.67 (76.74)	92.71 (74.38)	89.50 (71.16)	89.00 (70.66)	87.10 (68.99)	84.67 (66.98)	83.80 (66.28)	80.87 (64.07)	73.93 (61.16)	72.87 (58.62)
S.Em±	0.82	0.66	0.71	0.56	0.59	0.39	0.80	0.50	0.34	0.47	0.33	0.36	0.42
CD@1%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

*Figures in parenthesis are transferred values

Contd.....

Treatments	Storage months												
	0	1	2	3	4	5	6	7	8	9	10	11	12
V ₁ G ₁	83.00 (65.72)	82.33 (65.13)	82.67 (65.41)	81.33 (64.42)	79.67 (63.20)	75.67 (60.45)	76.33 (60.97)	76.00 (60.70)	72.67 (58.58)	71.00 (57.42)	68.33 (55.75)	65.67 (54.11)	63.00 (52.53)
V ₁ G ₂	86.00 (68.02)	83.33 (65.89)	82.00 (64.88)	81.33 (64.39)	80.00 (63.42)	77.00 (61.32)	75.00 (59.98)	73.00 (58.68)	73.00 (58.67)	71.33 (57.61)	68.00 (55.53)	69.33 (56.41)	65.67 (54.11)
V ₁ G ₃	84.67 (66.94)	83.00 (65.63)	81.67 (64.62)	80.00 (63.41)	78.33 (62.274)	76.00 (60.64)	74.33 (59.54)	72.00 (58.05)	73.33 (58.90)	71.33 (57.61)	68.33 (55.74)	66.67 (54.75)	63.00 (52.53)
V ₁ G ₄	84.00 (66.40)	83.00 (65.65)	82.33 (65.12)	81.33 (64.38)	80.00 (63.44)	77.00 (61.32)	75.00 (59.98)	73.00 (58.67)	73.00 (58.68)	71.33 (57.61)	69.00 (56.15)	66.67 (54.75)	63.67 (52.93)
V ₂ G ₁	83.67 (66.17)	78.67 (62.53)	78.33 (62.24)	76.67 (61.12)	76.00 (60.69)	73.67 (59.17)	73.67 (59.14)	73.00 (58.69)	69.33 (56.37)	67.33 (55.16)	65.67 (54.11)	62.33 (52.12)	58.00 (49.60)
V ₂ G ₂	78.67 (62.48)	78.00 (62.02)	76.67 (61.10)	75.33 (60.21)	74.00 (59.33)	72.67 (58.46)	70.67 (57.19)	70.00 (56.77)	71.00 (57.40)	67.33 (55.12)	64.33 (53.31)	61.33 (51.53)	56.67 (48.81)
V ₂ G ₃	77.33 (61.58)	78.67 (64.48)	77.00 (61.32)	76.00 (60.64)	74.33 (59.54)	72.67 (58.46)	70.67 (57.19)	68.67 (55.95)	68.67 (55.95)	68.00 (55.53)	64.00 (53.12)	61.67 (51.74)	57.33 (49.20)
V ₂ G ₄	78.33 (62.24)	78.00 (62.04)	76.67 (61.10)	76.00 (60.64)	75.33 (60.21)	75.33 (60.21)	71.00 (57.40)	70.00 (56.77)	67.67 (55.33)	67.33 (55.13)	64.33 (53.31)	61.67 (51.73)	57.33 (49.20)
V ₃ G ₁	78.33 (62.28)	77.67 (61.83)	76.67 (61.16)	75.00 (59.99)	77.67 (61.87)	74.00 (59.42)	73.00 (58.69)	72.00 (58.09)	72.67 (58.46)	68.67 (55.95)	64.00 (53.11)	60.33 (50.95)	56.67 (48.82)
V ₃ G ₂	78.00 (62.02)	78.00 (62.01)	76.67 (61.10)	75.33 (60.20)	74.33 (59.54)	72.67 (58.46)	71.33 (57.63)	71.33 (57.61)	68.67 (55.95)	68.67 (55.95)	64.33 (53.31)	59.67 (50.56)	55.00 (47.85)
V ₃ G ₃	77.67 (61.78)	76.33 (60.87)	75.67 (60.43)	75.00 (59.98)	73.00 (58.67)	70.33 (56.99)	69.33 (56.36)	68.67 (55.97)	66.67 (54.72)	64.00 (53.11)	62.00 (51.93)	59.33 (50.37)	56.00 (48.43)
V ₃ G ₄	79.00 (62.72)	77.00 (61.32)	75.67 (60.43)	74.67 (59.77)	73.00 (58.67)	71.33 (57.61)	71.00 (57.40)	68.67 (55.94)	70.00 (56.77)	65.67 (54.12)	59.67 (50.55)	59.67 (50.56)	56.33 (48.62)

Contd.....

Treatments	Storage months												
	0	1	2	3	4	5	6	7	8	9	10	11	12
V ₄ G ₁	82.00 (64.91)	81.67 (64.69)	82.00 (64.91)	79.00 (62.76)	77.00 (61.37)	73.00 (58.72)	71.00 (57.43)	71.67 (57.96)	71.00 (57.40)	69.00 (56.21)	69.67 (56.59)	68.67 (55.96)	64.33 (53.32)
V ₄ G ₂	82.67 (65.38)	82.67 (65.38)	81.67 (64.63)	80.00 (63.48)	78.67 (62.49)	75.33 (60.21)	74.67 (59.76)	73.00 (58.67)	72.00 (58.04)	70.33 (56.99)	67.33 (55.14)	65.00 (53.71)	62.00 (51.93)
V ₄ G ₃	83.33 (65.88)	82.00 (64.89)	80.67 (63.91)	79.67 (63.20)	78.00 (62.01)	76.00 (60.64)	75.00 (59.96)	72.67 (58.48)	72.33 (58.27)	70.67 (57.19)	67.00 (54.93)	64.67 (53.53)	62.33 (52.12)
V ₄ G ₄	80.67 (63.89)	81.33 (64.38)	81.67 (64.63)	79.67 (63.19)	78.00 (62.03)	75.00 (59.98)	74.33 (59.55)	72.33 (58.25)	70.33 (56.98)	69.33 (56.36)	66.67 (54.72)	64.67 (53.51)	62.00 (51.92)
V ₅ G ₁	84.33 (66.75)	83.33 (66.01)	81.33 (64.39)	80.00 (63.51)	78.67 (62.48)	75.67 (60.55)	72.67 (58.51)	72.00 (58.08)	75.00 (60.00)	72.67 (58.49)	67.67 (55.33)	67.00 (54.92)	65.00 (53.71)
V ₅ G ₂	84.00 (66.40)	82.67 (65.37)	81.33 (64.39)	80.33 (63.66)	78.67 (62.48)	77.00 (61.32)	76.00 (60.65)	73.00 (58.67)	70.67 (57.19)	69.67 (56.56)	68.67 (55.95)	67.33 (55.14)	63.67 (52.92)
V ₅ G ₃	83.00 (65.63)	82.33 (65.13)	80.67 (63.89)	79.67 (63.18)	77.00 (61.32)	76.00 (60.64)	74.33 (59.54)	73.00 (58.69)	70.00 (56.77)	69.00 (56.15)	69.33 (56.36)	66.00 (54.31)	62.00 (51.94)
V ₅ G ₄	83.67 (66.16)	83.67 (66.17)	80.33 (63.69)	81.33 (64.40)	78.67 (62.48)	75.67 (60.42)	74.67 (59.76)	72.67 (58.46)	70.67 (57.19)	69.33 (56.36)	66.67 (54.71)	67.67 (55.33)	65.00 (53.72)
MEAN	81.58 (64.64)	80.72 (64.00)	79.58 (63.17)	78.38 (62.33)	77.02 (61.38)	74.60 (55.75)	73.20 (58.83)	71.83 (57.96)	70.93 (57.38)	69.10 (56.23)	66.25 (54.48)	64.27 (53.30)	60.75 (51.20)
S.E.m _±	0.80	0.94	0.76	0.90	1.01	1.03	0.99	1.21	0.83	1.00	0.72	1.01	0.97
CD@1%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of Seed Size on Seedling Vigour Index in Different Chickpea Genotypes

Treatments	Storage Months												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Genotypes (V)	Seedling Vigour												
A-1 (V ₁)	2450	2383	2267	2126	2041	1945	1833	1730	1638	1544	1438	1289	1132
ICCV-2 (V ₂)	2410	2359	2267	2150	2097	1989	1878	1728	1602	1530	1367	1277	1187
KAK-2 (V ₃)	2609	2507	2366	2237	2155	2043	1918	1792	1722	1653	1490	1330	1206
Bheema (V ₄)	2786	2688	2551	2423	2337	2226	2107	1986	1876	1783	1656	1436	1239
BGD-103 (V ₅)	2947	2771	2581	2461	2368	2263	2171	2081	1970	1859	1695	1510	1407
S.Em±	32	36	27	27	27	19	25	28	20	18	19	14	18
CD@1%	122	138	105	102	105	75	97	107	78	70	71	55	69
Seed Size													
Small (G ₁)	2582	2495	2362	2234	2159	2065	1950	1828	1741	1673	1512	1383	1243
Medium (G ₂)	2670	2570	2435	2304	2216	2099	1992	1878	1765	1669	1534	1376	1227
Big (G ₃)	2724	2602	2456	2319	2246	2134	2031	1912	1820	1708	1574	1393	1245
Bulk (G ₄)	2585	2500	2372	2260	2177	2076	1953	1835	1720	1645	1496	1321	1221
S.Em±	29	32	25	34	25	17	23	25	18	16	17	13	16
CD@1%	109	123	94	91	94	66	86	95	70	62	64	50	62

Contd.....

Treatments	Storage Months												
	0	1	2	3	4	5	6	7	8	9	10	11	12
V ₁ G ₁	0.340	0.350	0.357	0.370	0.383	0.400	0.470	0.510	0.533	0.587	0.677	0.727	0.893
V ₁ G ₂	0.357	0.360	0.380	0.390	0.407	0.483	0.523	0.547	0.570	0.647	0.743	0.783	0.937
V ₁ G ₃	0.367	0.380	0.420	0.437	0.443	0.507	0.530	0.580	0.603	0.647	0.767	0.833	0.987
V ₁ G ₄	0.347	0.390	0.380	0.390	0.410	0.453	0.513	0.550	0.563	0.640	0.723	0.860	0.953
V ₂ G ₁	0.393	0.400	0.413	0.463	0.483	0.520	0.577	0.650	0.727	0.763	0.863	0.890	0.977
V ₂ G ₂	0.400	0.403	0.447	0.470	0.520	0.557	0.673	0.690	0.763	0.847	0.900	0.917	1.197
V ₂ G ₃	0.420	0.430	0.473	0.483	0.537	0.580	0.687	0.700	0.743	0.863	0.900	1.020	1.217
V ₂ G ₄	0.407	0.417	0.420	0.470	0.533	0.553	0.593	0.643	0.740	0.803	0.917	1.027	1.117
V ₃ G ₁	0.453	0.463	0.477	0.483	0.517	0.553	0.587	0.640	0.700	0.740	0.793	0.913	1.183
V ₃ G ₂	0.473	0.483	0.493	0.500	0.550	0.587	0.657	0.680	0.743	0.777	0.880	0.953	1.247
V ₃ G ₃	0.493	0.507	0.520	0.527	0.570	0.593	0.637	0.693	0.760	0.783	0.923	1.047	1.323
V ₃ G ₄	0.470	0.480	0.490	0.503	0.540	0.557	0.633	0.673	0.730	0.777	0.877	0.973	1.233
V ₄ G ₁	0.370	0.380	0.407	0.430	0.480	0.513	0.543	0.553	0.579	0.647	0.717	0.783	0.983
V ₄ G ₂	0.377	0.377	0.423	0.447	0.507	0.523	0.553	0.627	0.633	0.677	0.787	0.857	1.050
V ₄ G ₃	0.400	0.393	0.447	0.457	0.510	0.523	0.580	0.643	0.630	0.700	0.823	0.910	1.150
V ₄ G ₄	0.380	0.387	0.423	0.443	0.460	0.527	0.567	0.603	0.633	0.663	0.800	0.897	0.977
V ₅ G ₁	0.340	0.370	0.383	0.397	0.427	0.447	0.477	0.530	0.550	0.630	0.710	0.747	0.900
V ₅ G ₂	0.357	0.393	0.400	0.417	0.440	0.487	0.530	0.580	0.590	0.680	0.763	0.860	1.043
V ₅ G ₃	0.370	0.387	0.430	0.433	0.440	0.490	0.543	0.620	0.600	0.713	0.813	0.917	1.143
V ₅ G ₄	0.350	0.363	0.400	0.403	0.437	0.443	0.523	0.560	0.647	0.653	0.787	0.870	1.057
MEAN	0.393	0.406	0.429	0.448	0.479	0.505	0.570	0.614	0.653	0.712	0.808	0.889	1.078
S.Em±	0.010	0.018	0.012	0.009	0.017	0.024	0.029	0.021	0.022	0.019	0.018	0.029	0.040
CD@1%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3: Effect of Seed Size on Electrical Conductivity in Different Chickpea Genotypes

Treatments	Storage Months												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Genotypes (V)	Electrical Conductivity (dSm ⁻¹)												
A-1 (V ₁)	0.353	0.370	0.384	0.397	0.411	0.461	0.509	0.547	0.568	0.630	0.728	0.801	0.943
ICCV-2 (V ₂)	0.405	0.413	0.438	0.472	0.521	0.553	0.633	0.671	0.743	0.819	0.895	0.963	1.127
KAK-2 (V ₃)	0.473	0.483	0.495	0.503	0.544	0.573	0.628	0.672	0.733	0.769	0.868	0.972	1.247
Bheema (V ₄)	0.382	0.384	0.425	0.444	0.487	0.522	0.561	0.607	0.623	0.672	0.782	0.862	1.040
BGD-103 (V ₅)	0.354	0.378	0.403	0.413	0.436	0.467	0.518	0.573	0.597	0.669	0.768	0.848	1.036
S.Em±	0.05	0.009	0.006	0.004	0.008	0.012	0.015	0.010	0.011	0.010	0.009	0.014	0.020
CD@1%	0.019	0.034	0.024	0.017	0.032	0.046	0.056	0.040	0.043	0.037	0.035	0.055	0.077
Seedsize													

Table 3: Contd.,

Small (G ₁)	0.379	0.395	0.407	0.429	0.458	0.487	0.531	0.577	0.622	0.673	0.752	0.812	0.987
Medium (G ₂)	0.393	0.407	0.429	0.445	0.485	0.527	0.587	0.625	0.660	0.725	0.815	0.874	1.095
Big (G ₃)	0.410	0.430	0.458	0.467	0.500	0.539	0.595	0.647	0.667	0.741	0.845	0.945	1.164
Bulk (G ₄)	0.391	0.411	0.423	0.442	0.476	0.507	0.566	0.606	0.663	0.707	0.821	0.925	1.067
S.Em±	0.004	0.008	0.006	0.004	0.008	0.011	0.013	0.009	0.010	0.009	0.008	0.013	0.018
CD@1%	0.017	0.030	0.021	0.015	0.029	0.041	0.050	0.035	0.038	0.033	0.031	0.049	0.069

Contd.....

Treatments	Storage Months												
	0	1	2	3	4	5	6	7	8	9	10	11	12
V ₁ G ₁	8.82	8.88	8.90	9.00	9.08	9.12	9.25	9.33	9.35	9.49	9.69	9.85	10.21
V ₁ G ₂	8.87	9.00	9.00	9.07	9.13	9.17	9.29	9.40	9.44	9.57	9.73	9.96	10.23
V ₁ G ₃	8.90	9.03	9.10	9.12	9.15	9.18	9.33	9.47	9.52	9.66	9.80	9.93	10.27
V ₁ G ₄	8.82	8.95	8.93	9.07	9.08	9.17	9.28	9.35	9.41	9.58	9.76	9.87	10.22
V ₂ G ₁	9.05	9.00	9.03	9.08	9.08	9.17	9.23	9.36	9.45	9.52	9.69	9.90	10.20
V ₂ G ₂	9.08	9.08	9.10	9.12	9.13	9.29	9.31	9.42	9.50	9.57	9.78	10.07	10.27
V ₂ G ₃	9.10	9.12	9.17	9.15	9.18	9.25	9.34	9.44	9.52	9.68	9.86	10.20	10.32
V ₂ G ₄	9.05	9.03	9.03	9.07	9.13	9.18	9.33	9.41	9.44	9.59	9.83	9.90	10.22
V ₃ G ₁	8.97	9.08	9.07	9.08	9.12	9.18	9.28	9.38	9.51	9.68	9.78	10.17	10.65
V ₃ G ₂	9.07	9.12	9.12	9.15	9.20	9.20	9.35	9.41	9.58	9.70	9.85	10.20	10.78
V ₃ G ₃	9.08	9.15	9.13	9.17	9.25	9.30	9.38	9.47	9.62	9.74	9.89	10.28	10.88
V ₃ G ₄	9.08	9.08	9.12	9.08	9.17	9.25	9.32	9.47	9.55	9.71	9.84	10.12	10.78
V ₄ G ₁	8.93	8.97	9.02	9.05	9.10	9.15	9.28	9.28	9.40	9.49	9.64	9.82	10.45
V ₄ G ₂	8.98	8.98	9.07	9.13	9.13	9.22	9.28	9.43	9.47	9.59	9.72	10.13	10.64
V ₄ G ₃	9.03	9.08	9.12	9.13	9.15	9.23	9.30	9.46	9.48	9.66	9.75	10.32	10.80
V ₄ G ₄	8.88	8.98	9.07	9.07	9.10	9.18	9.33	9.40	9.45	9.63	9.71	9.90	10.62
V ₅ G ₁	8.97	8.98	8.90	8.98	9.03	9.15	9.15	9.32	9.38	9.50	9.65	9.77	10.16
V ₅ G ₂	9.02	9.05	9.05	9.07	9.13	9.20	9.22	9.41	9.42	9.59	9.73	9.92	10.27
V ₅ G ₃	9.04	9.10	9.08	9.13	9.17	9.20	9.28	9.47	9.44	9.62	9.59	10.13	10.28
V ₅ G ₄	9.03	9.03	9.02	8.98	9.07	9.15	9.20	9.37	9.41	9.55	9.78	9.83	10.20
MEAN	8.98	9.03	9.05	9.08	9.13	9.20	9.29	9.40	9.47	9.61	9.75	10.01	10.42
S.Em±	0.05	0.61	0.06	0.04	0.04	0.04	0.04	0.03	0.03	0.02	0.05	0.11	0.05
CD@1%	NS	2.32	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS